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KEITHIA ON CHAMAECYPARIS THYOIDES

By J. F. ADAMS

The genus *Keithia* was originally established by Saccardo* to include *Phacidium tetrasporum* Phil. & Keith on *Juniperus communis*.

Durand† in his discussion of the genus included *Stictis Tsugae* Farlow on *Tsuga canadensis* and a new species *K. thujina* Durand on *Thuja occidentalis*. The latter species was collected by Dr. J. J. Davis in Wisconsin, 1908. The genus thus came to include three species which are parasitic on the leaves of *Juniperus communis*, *Thuja occidentalis*, and *Tsuga canadensis*.

Since Durand's paper on the genus *Keithia* appeared Weir‡ has reported *K. Thujina* on *Thuja plicata* and states that it is widely distributed throughout the range of its host. The same species has been collected on *T. occidentalis* in Walden, Vermont (July 4, 1917), by Professor C. R. Orton, which is the first report of the species that far east.

In the summer of 1915 Professor R. A. Harper and Dr. B. O. Dodge collected a discomycetous fungus on *Chamaecyparis thyoides* at Lakehurst, New Jersey, which plainly belongs to the genus *Keithia*. Material was turned over to the writer for cytological and morphological study and additional material was collected June 14, 1916.

The white cedars that were infected in 1915 were carefully examined in April, 1916, but no symptoms of infection were

* Saccardo. Syll. Fung. 10: 49. 1892.

† Durand, E. J. The Genus *Keithia*. Mycologia 5: 6-12. 1913.

‡ Weir, J. R. *Keithia Thujina*, the cause of a serious leaf disease of the Western Red Cedar. Phytopathology 6: 360-363. 1916.

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evident. On a later trip (June 14, 1916) to the same vicinity the trees showed scattered infections. The infected leaves appeared brown and small apothecia of the fungus could be recognized. The apothecia develop on the upper surface of the leaves as circular or elongated pustules slightly raised above the leaf surface. The overlying part of the epiderm ruptures along the margin of the apothecium and for some time is retained as a flap or scale as

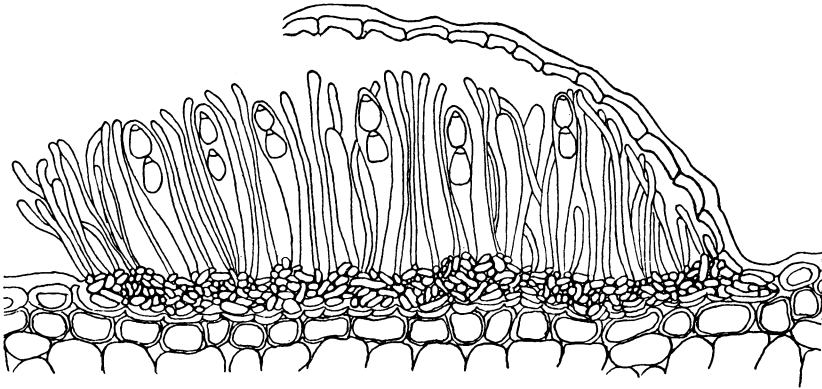


FIG. 1. A cross section of an apothecium of *Keithia* on *Chamaecyparis thyoides*. This shows its epidermal development and marginal dehiscence with the overlying flap or scale which consists of the upper half of the epidermal cell walls with the thickened cuticle. The margins consist of filaments similar in form to the paraphyses forming there a false excipulum.

described for *K. thujina*. The exposed apothecia are brownish in color and resemble sori of uredospores. It was observed that as a rule infection was confined to the lateral leaves. In the majority of cases dead terminal leaves were found to be infected with *Lophodermium Juniperinum* Fries. This fungus appeared to be more prevalent than *Keithia*. Ellis and Everhart* have reported it on *Chamaecyparis thyoides* from Newfield, New Jersey, as occurring on dead leaves.

Weir has emphasized the importance of *K. thujina* as a dangerous parasite on *Thuja plicata*. Observations by Dr. J. J. Davis in Wisconsin indicate that it is not serious, since only a limited amount of leaf tissue is destroyed. The vigor of the trees is not

* Ellis, J. B., & Everhart, B. M. The North American Pyrenomycetes, 718, 1892.

impaired. Our observations of the fungus on *Chamaecyparis* agree with those of Davis. As previously noted, the *Lophodermium* appears more destructive than *Keithia*. It is plainly possible, however, that under more favorable conditions these fungi might become serious.

The form of *Keithia* on *Chamaecyparis* differs in several points from *Keithia Thujina* on *Thuja*. Specimens of the collections by Davis, Weir and Orton deposited in the herbarium of the New York Botanical Garden have been compared.

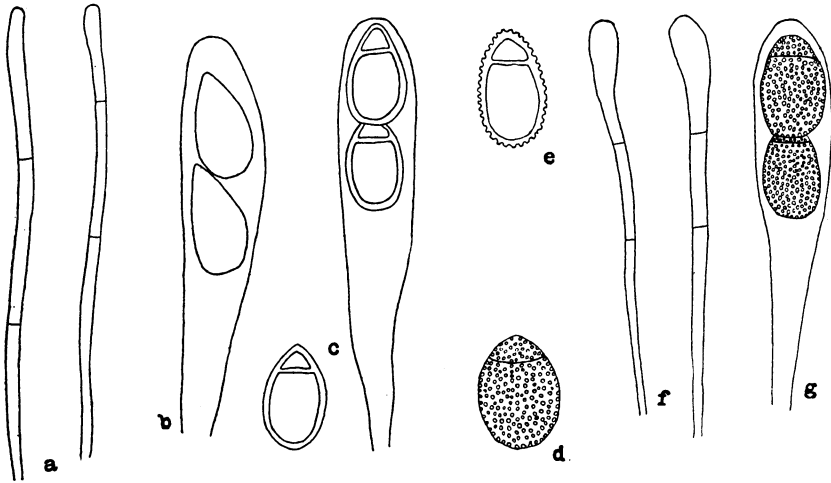


FIG. 2. a-c. *Keithia* on *Chamaecyparis thyoides*. a, paraphyses; b, immature ascus; c, matured spore and ascus; d-g, *Keithia thujina*; d and e, surface and sectioned view of mature spores; f, paraphyses; g, matured ascus.

The fungus develops in the epidermal layer in such a manner that the cells are split. The portion raised above the apothecia consists of the upper halves of the epidermal cell walls with the thickened cuticle. *Keithia Thujina* on *Thuja* develops sub-epidermally and the hyphae of the fungus are conspicuous in the mesophyll of the leaf.

The variation in the spores is the most characteristic difference. The spores of our form are smooth walled in contrast to the pitted walls found in *K. Thujina*. In both forms the spores are divided into two unequal cells, the distal one being much smaller. The two spores occur end to end in the ascus with the

small end of each spore always uppermost. Branching paraphyses were not observed nor are the paraphyses so enlarged at their ends as in the form on *Thuja*. The margin of the apothecium consists of filaments similar in form to the paraphyses forming there a false excipulum. The hypothecium is poorly developed. Durand has referred to the weak development of the excipulum and hypothecium in all the species of *Keithia*. On the basis of his studies he is of the opinion that the affinities of *Keithia* are not with the Phacidiaceae as contended by Saccardo but with the Stictidiaceae.

The manner of dehiscence, the poorly developed excipulum and hypothecium and the soft, waxy condition of the apothecia are certainly characters showing relationship to Stictidiaceae rather than to the Phacidiaceae.

The differences mentioned are made the basis on which the following new species is described.

***Keithia Chamaecyparissi* sp. nov.**

Apothecia epiphyllous, intra-epidermal, erumpent by marginal dehiscence of overlying cell walls in form of scale, slightly elevated, cushion-like, waxy, olive brown, circular, elliptical or curved, $135\text{--}300\mu$ broad \times $430\text{--}1025\mu$ long; asci two-spored, elongate clavate, $13\text{--}18 \times 72\text{--}90\mu$; paraphyses filiform, septate, slightly longer than asci, ascospores at first hyaline, becoming olive brown when mature, continuous when young, divided into two unequal cells, the distal one smaller, pyriform-ellipsoid, $10\text{--}13 \times 15\text{--}24\mu$.

On leaves of *Chamaecyparis thyoides* (L.) B.S.P.

Type locality: Lakehurst, New Jersey.

Distribution: Known only from the type locality.

Specimens have been deposited in the herbarium of the Botanical Department of Columbia University and the New York Botanical Garden.

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